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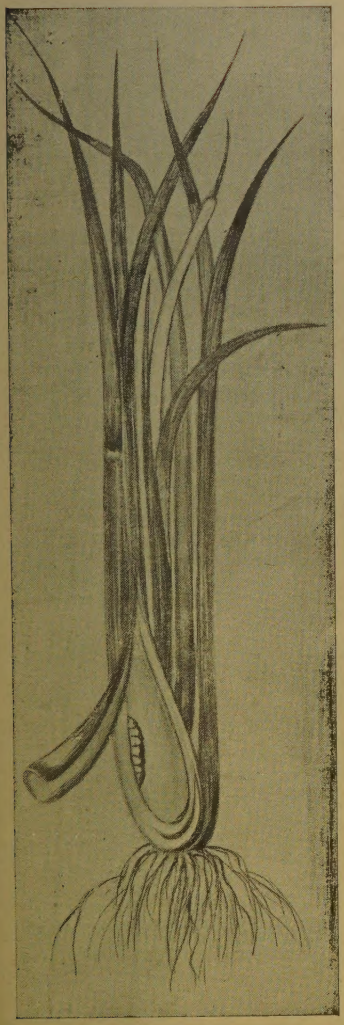

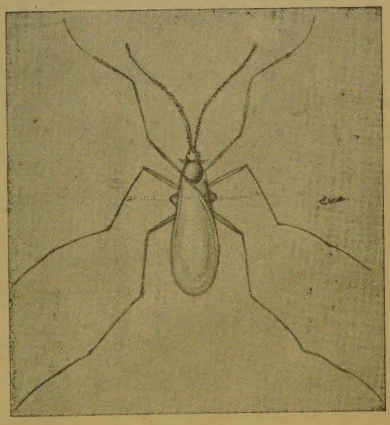

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SPRAYING OPERATIONS FOR CONTROL OF 'LATE BLIGHT' OF POTATO IN THE HIMALAYAN HILLS IN DARJEELING DISTRICT

by

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INTRODUCTION

Potato is one of the main cash crops in the mountainous tracts of Himalayas in the Darjeeling district of West Bengal. It is cultivated extensively in the sub-temperate and temperate tracts of the Himalayas in the months of spring and summer. The area under the crop is between 3,500 and 4,000 acres. The varieties commonly grown are 'Darjeeling Red Round'. 'White Long', 'Great Scot'. 'Darjeeling Red Round' is almost exclusively grown for supplying seed tubers to the plains of West Bengal, Bihar and U.P. whereas potato raised from white varieties are mainly intended for food and seed purposes to be used up locally. Climatic conditions in the higher altitudes in the hills in Darjeeling district enable the cultivators to raise practically virus-free seed-tubers and consequently potato grown in these tracts is highly valued as seed. Successful cultivation of potato in the plains of West Bengal is dependent to a great extent on the supply of seed-tubers from Darjeeling district.

The normal time of sowing of tubers in the hills in Darjeeling district is December—February, and the plants are harvested from end of May to the beginning of August. Plants are in stage of active growth in the months of April and May and in the early part of June also. Average yield of potato in Darjeeling district is very poor—3,280 to 3,690 lbs. per acre. Among the various factors responsible for such low yield, 'late blight' caused by *Phytophthora infestans* (Mont.) de Bar yplays a very important part.

'Late blight' of potato has been known to occur in the Darjeeling district for a long time. Although the seed from these areas was highly valued as seed for the plains, and fetched high price, there was little incentive for the cultivators to grow the crop because of serious damage caused by 'late blight' and consequently low yields. 'Darjeeling Red Round' potato seed has always been in great demand for sowing in the plains of Uttar Pradesh and Bihar and the scarcity of seed supply has always been felt by these importing centres. Dastur *(1915) has discussed the factors for the non-existence of 'late blight' disease in the plains even when tubers from affected areas were imported. Perhaps the greatest value of the seed from Darjeeling area appeared to be in their being relatively free from virus diseases. With the establishment of cold storage facilities in the plains, the danger of introducing 'late blight' in the plains from

*Dastur, J. F.—The Potato Blight in India. Mem. Deptt. of Agriculture India. Bot., 7 : 163—176.

infected tubers imported from the hills is now great. Already this disease is now being regularly reported in certain areas in the plains of Bihar and Uttar Pradesh. Under the changed conditions, now prevailing in the seed trade, it is likely that the importers will lay much greater emphasis on freedom from ' late blight ' infection in seed-tubers. If Darjeeling district has to retain its premier position in the seed trade, it must ensure a supply of seeds free from ' late blight ' infection. (Seed-tubers are imported in fairly large quantities into Darjeeling District (Darjeeling, Ghum and Sookeapoorki markets) from Nepal and Sikkim. The seed-tubers sold in the plains as ' Darjeeling seed potato ' are therefore, not necessarily the produce of Darjeeling District alone).

Before initiation of Plant Protection Scheme no concrete measure was taken up to control the disease of ' late blight ' in a field scale except in a year or two, when potato plants of cultivators' plots in a very restricted area round the Alubasti near Darjeeling were sprayed with 1 per cent Bordeaux Mixture for control of disease. But never a comprehensive scheme aiming at control of the disease in large tracts was attempted. One progressive cultivator of Karmi Estate, Darjeeling, attempted to control the disease by spraying, but his trials did not create any enthusiasm among the local cultivators.

Annual recurrence of the disease in epidemic form is due to two important factors, namely the use of infected mother tubers and the climatic conditions prevalent during the period of crop growth. In these areas no special care is taken in raising and selection of tubers for seed purposes. Tubers from affected plots are very often kept for seed and consequently plants from such tubers often remain infected and serve as foci of primary infection. Climatic conditions also play a very important part in the spread of the diseases. Average relative humidity during the period of April to June varies from 85—97 per cent, and it gradually increases with approach of monsoonic weather. Persistent foggy conditions often prevail during the later part of the day and early part of the night and it rains frequently. Temperature during the period also remains favourable for the disease (minimum temperature 50—57°F.). A great deal of work has been done on the effect of weather conditions favouring ' late blight ' incidence. As a result of these studies, forecasting and spray warning services have been developed in many countries, notably in Holland and England. Miller and O'Brien* have recently reviewed the work done on this topic in the various countries. In view of the observations made in Holland and England regarding optimum weather conditions for appearance of blight, it may be stated that climatic conditions during the growing period of potato in the hills of Darjeeling district, are highly favourable for outbreak and spread of the disease. Under the Plant Protection Scheme, spraying operations on extensive scale were undertaken for control of this most serious disease of potato in the hills of Darjeeling district, for four consecutive years namely 1949, 1950, 1951 and 1952. During the first year the operations were carried out on a

*Miller, P. R. and O'Brien M. Plant disease forecasting. Bot. Rev., 18 No. 2, 1952.

small scale, because of the lack of familiarity with the locality, its topography, practical difficulties etc. Moreover, it was essential to win the confidence of the growers and to obtain their full support for success of the operation. There was no previous experimental data to guide the author on the choice of fungicide, and its strength, frequency of spraying, suitable machine etc.

SPRAYING TRIALS

In the first year (1949), three fungicides, namely ' Perenox ', ' Dithane D-14 ' and ' Dithane Z-78 ' were tried on a large scale. Bordeaux mixture (1 per cent) was also used in a number of plots. In spite of its high tenacity, Bordeaux mixture was not found suitable, as it tended to be phytotoxic to the plants under conditions of high humidity and poor light. Perenox (applied at the rate of 4 lbs. per 100 gallons) was found to have low tenacity and even with a sticker (Albolineum No. II), did not prove satisfactory. Moreover, Perenox was found to damage maize plants which are commonly grown in interculture with potato. Dithane D-14 and Dithane Z-78 proved to be very satisfactory, of which the former appeared to show better performance, because of its greater tenacity and uniform suspension in water. The Dithanes were safe for use in all stages of growth and also non-phytotoxic to other plants viz., maize and pea, which are commonly grown as interculture crops with potato. Repeated application of these fungicides did not show any adverse effect such as stunting, but on the other hand vegetative growth was encouraged. These fungicides were found to be highly efficacious in controlling the disease. Dithane Z-78 is a water dispersible powder with a tendency to settle at the bottom unless stirred frequently. Preparation of Dithane D-14 is cumbersome and certain precautions are to be taken at the time of mixing of different ingredients.

Regarding dosages of the various fungicides, it was found by field trial, that with Dithane Z-78 best results are obtained at the rate of 2 lbs. per 100 gallons and with Dithane D-14 at the rate of ½ gallon plus 1½ lbs. of Zinc sulphate (24 per cent Zinc) and 1½ lbs. of Lime per 100 gallons. With Perenox, 4 lbs. per 100 gallons is the optimum dose.

The next important aspect for consideration was the time for commencement of spray, number of sprays needed and the interval between two successive sprays. Experience of four years' work show that spraying should commence by the middle of April, as from the last week of April onwards climatic conditions become more favourable for the outbreak and spread of the disease. Spraying should continue till the beginning of June after which, for all practical purposes, further application was considered unnecessary.

Interval between two successive sprays was kept varied from 10—12 days under normal conditions. During long spells of rainy weather, the interval was shortened to 7-8 days. Altogether 4-5 sprays are required for control of the disease. In the fourth year (1952), 3 sprayings in all were given, because due to repeated application of fungicides for successive years, intensity of the disease was lowered, and three applications

were found to be sufficient. In this connection, it may be stated that 1-2 applications of Dithanes did not control the disease effectively. Similarly late applications did not often give desired results and created disbelief among the cultivators regarding effectiveness of the fungicides concerned.

The choice of right type of sprayer also demanded a great consideration. Spraying in all cases should be in the form of a very fine mist so as to cover both the surfaces of the leaves, particularly the lower surface. Sprayers with good delivery were required so that comparatively large area could be covered within a short time. In the year 1949, a very light and portable power sprayer (Silver Prince 3|4 H.P. supplied by Messrs. Water Supply Specialists Ltd.) was used in the hills. It was observed that power sprayers could not be conveniently used in the hills due to practical difficulties, namely the plots are terraced and of very small size ; there was hardly any ' bundh ' or border of the plots to enable the operator to take the sprayer from one plot to the other, from one locality to other and keep the sprayer in a position to be conveniently operated. Moreover, there was always the difficulty of repair in case of any break-down because the potato growing areas are located always far from the town. Use of power sprayers in the hills was found to be impracticable and even uneconomical.

It became, therefore, necessary to take recourse to hand sprayers which would be capable of working at a pressure of 75—80 lbs. per square inch and would also be reasonably big to minimise the number of fillings to avoid loss of time. By experience it was found that a battery of compressed air sprayers operated by a central charge pump was most suitable. These sprayers required pumping of air once in the beginning of the day. Once pumped, air remains at 30 lbs. pressure unless released through special valve. Only the spray liquid had to be pumped in. By the use of this type of sprayer, time and energy used in filling up liquid and pumping at the end of each complete discharge was saved. The efficiency of this sprayer was approximately 50 per cent more than ' Four Oaks Kent No. 2 ' which was found to be the next best. The former could cover 2½ acres per day as against 1½—1¾ acres covered by one ' Four Oak Kent No. 2 ' sprayer. Other types of sprayers were not found to be of much use in the hills.

RESULTS

In the Darjeeling district, ' late blight ' of potato takes a heavy annual toll. In order to achieve any measure of success, it was desirable that the spraying operations be carried out systematically over a wide area. Table 1 will give an idea of the extent to which the spraying operations were carried out during the four year period under review. It can also be seen from Table 1 that with repeated spraying the level of infection became lower, so much so that as against 5 spraying operations in 1949 only 3 sprayings were necessary in 1952 to completely check the disease.

As a result of intensive spraying there was an overall increase in the yield. From random sample survey in different areas, it was found that the increase in yield due to spraying was from 38—126 per cent (Table 2). The approximate overall increase in yield in the sprayed areas has been indicated in Table 1 and the quantities of the different fungicides used during the 4 years' operational period is shown in Table 3.

In all control operations it is desirable to know if the cost, in money and effort, is materially less than the loss from the disease. It was calculated that altogether four sprayings were necessary to completely control the disease and the total cost of the operations would be approximately Rs. 48|- per acre. It was also ascertained that additional yields likely to accrue from the control operations would be about 15 maunds per acre (1230 lbs.) and at the prevailing market rates, this additional yield would fetch appoximately Rs. 150|- more per acre. It would thus ensure a profit of about Rs. 100|- per acre. The cost of spraying operation was computed as follows :—

Cost per spray :—

	Rs.
1. Cost of Chemical (fungicide) per acre .. .. (Calculated on the basis that 2 lbs. of Dithane Z-78 will be used per 100 gallons and 60—70 gallons of solution are required per spray.	8
2. Cost of labour per acre .. .. (Calculated on the basis that one labourer would be able to cover an acre per day).	2
3. Incidental (Cost of transport and depreciation of machinery)	2
	12
Cost of four sprayings	48
Increase in the yield, approximately 15 mds. per acre at Rs. 10 per maund of potato	150
Profit per acre	102

So the profit comes to Rs. 102 per acre even under conditions of low yield in Darjeeling district.

It will not be out of place to mention that the work in the hills of Darjeeling District was beset with numerous practical difficulties, because of topography, communication and transport difficulties. The cultivators were quick to realise the benefits of the control measures that were being undertaken and they heartily cooperated with the work. But for this fact it would not have been possible to spray a major portion of the area under the crop in the hills. The Department of Agriculture, Bengal can justifiably take pride in these operations which have not only augmented the food production but has also financially helped the poor cultivators of the hills. These operations have also shown a way to the farmers to increase their crop yields by application of more modern scientific methods.

TABLE 1.

Statement of Potato Spraying Work in the Hills in the Years 1949-52.

Centre	Altitude	Area covered in Acres				Number of Sprays given			
		1949	1950	1951	1952	1949	1950	1951	1952
Sonada ..	6,000′—7,000′ ..	65	260	430	486	4	4	4	3
Sookeapookri	6,000′—7,000′ ..	100	225	330	401	3	3	4	3
Karmi ..	4,000′—6,000′ ..	60	55	40	83	5	3	4	3
Relling ..		30	40	51	..	5	4	4	..
Ladhama ..	4,000′—7,000′ ..	306	710	802	1,250	5	4	4	3
Rimbick ..	6,000′—7,500′ ..	150	200	303	295	4	3	4	3
Srikhola ..	6,000′—8,000′ ..	296	475	558	550	5	3	4	3
		1,007	1,965	2,514	3,065				
Approximate increase in yield in tons		500	1,000	1,200	1,500				

TABLE 2.

Assessment of increase in yield due to control of Late Blight of Potato by spraying in Darjeeling District, West Bengal

Locality	Variety	Sprayed or unsprayed	Average yield per 1/200th of an acre* lbs.	Increase in yield due to spraying %	Remarks
Rimbic ..	Red Round ..	Unsprayed ..	40	108	Blight in these localities appeared by the middle of May.
	Do ..	Sprayed ..	83		
	White long ..	Unsprayed ..	34	126	
	Do ..	Sprayed ..	77		
Majhua ..	Red Round ..	Unsprayed ..	16	66	
	Do ..	Sprayed ..	26		
	White long ..	Unsprayed ..	20	75	
	Do ..	Sprayed ..	35		

TABLE 2—*contd.*

Locality	Variety	Sprayed or unsprayed	Average yield per 1/200th of an acre lbs.	Increase in yield due to spraying %	Remarks
Plungdung ..	Red Round ..	Unsprayed ..	29	38	
	Do ..	Sprayed ..	40		
	White long ..	Unsprayed ..	20	100	
	Do ..	Sprayed ..	40		
Karmi ..	Red Round ..	Unsprayed ..	32	78	
	Do ..	Sprayed ..	57		

*From random sample survey areas in which assessment was made.

TABLE 3.

Quantities of Fungicides used during the spraying operations done from 1949 *to* 1952.

Fungicides used (Total Quantity)

1949	1950	1951	1952
Perenox—4 tons	—	—	—
Dithane D—14 .. .. .. 180 gallons	Dithane D—14 1,015 gallons	Dithane D—14 1,015 gallons	Dithane D—14 1,750 gallons.
Dithane Z—78, 6001 bs.	Dithane Z—78 3,300 lbs	Dithane Z—78 6,300 lbs.	Dithane Z—78 4,800 lbs

SOME MORE OBSERVATIONS ON THE TRIAL OF PROPRIETARY INSECTICIDES IN INDIA

INTRODUCTION

With a view to recommending useful new insecticides to the cultivators, a number of proprietary insecticides were given field trials to test their efficacy, determine their effective dosages against various insect pests under Indian conditions and to observe their phytotoxicity on crops. Those tried so far include chlorinated hydrocarbons (DDT, BHC, Chlordane, Toxaphene, thiocyanate (Lethane), phosphatic insecticides (TEPP, Parathion and systemic insecticide like OMPA (Octamethyl-phosphoramide) and the plant derivative insecticides such as pyrethrum and nicotine. Those which have proved useful and the concentrations in which they are effective against the important crop pests are discussed below.

CHLORINATED HYDROCARBONS

DDT (*Dichloro-diphenyl-trichloro-ethane*) DDT has been tried and found effective against many crop pests. As 2 per cent dust, it was effective against the red pumpkin beetle (*Aulacophora foveicollis*) which is generally a major post of cucurbitaceous crops throughout India. To avoid any phytotoxicity to the plants it is advisable to dust 1 per cent DDT on the germinating cucurbit plants. It should be noted that to avoid phytotoxicity DDT should not be used as spray on cucurbitaceous crops and that dusting these crops with DDT should also be conducted when the right amount of dew is present on the plants.

Two per cent DDT dust gave good results against the chafer beetles (*Adoretus* spp.) feeding on the foliage of ' falsa ' (*Grewia asiatica*), grape vine and guava, etc. during the rainy season. Five per cent DDT dust when tried on cotton crop against cotton jassid (*Empoasca devastans*) gave over 80 per cent kill of the pest. It was observed that, in the control of cotton jassid, spraying with 0.2 per cent DDT was more effective than dusting with 5 per cent DDT. DDT as 10 per cent was found effective against the houshold pests such as cockroaches, crickets and white ants causing different types of damage to eatables, clothes, books and upholstry.

As a spray, DDT had been tried mostly as wettable powder which in concentration of 0.12 per cent proved highly effective against cabbage butterfly (*Pieris brassicae*) occurring as a pest of cruciferous crops in Kulu valley. The caterpillars were more susceptible to its contact effect than to stomach poisoning. In concentration of 0,2 per cent. it was effective against pyrilla pest of sugarcane, mango hoppers (*Idiocerus* spp.) infesting mango, lemon butterfly (*Papilio demoleus*) on citrus nursery and young plantations and chafer beetles (*Adoretus* spp.) referred above. The heavy infestation of hairy caterpillars (*Euproctis lunata*) on castor and its subsequent spread over other vegetation was checked by spraying the

infested plants with 0.25 per cent. DDT. In all the above trials DDT used was Geigy's Vivifex, De De Tane (Murphy), Diatomite and Torch Brand Kitkari samples.

BHC (Benzene hexachloride).—BHC had been widely in use against many crop pests. In concentration of 3.3 per cent to 3.5 per cent dust, it proved effective against the larvae of mustard saw fly (*Athalia proxima*) infesting radish, mustard and turnip crops, adults of red pumpkin beetle (A. *foveicollis*) feeding on cucurbitaceous crops and the grubs and adults of singhara beetle (*Galerucella birmanica*) damaging ' singhara ' (water-nut) crop. Five per cent BHC dust proved effective against *Pyrilla* nymphs, black bug of sugarcane (*Macropes excavatus*) and brown weevils (*Myllocerus blandus*) infesting sugarcane, gram caterpillar (*Heliothis armigera*) boring tomato fruit, surface grass hopper nymphs (*Chrotogonus* spp.) and grey weevil (*Myllocerus pustulatus* var. *maculosus*) damaging ' jowar ' (sorghum) and maize. 7 per cent to 10 per cent BHC dust was effective against sucking insects such as adults of pyrilla on sugarcane, paddy ear bug (*Leptocorisa varicornis*), brinjal tingid bug (*Urentius echinus*) and cabbage aphis (*Brevicoryne brassicae*) and adult surface grasshoppers (*Chrotogonus* spp.) as mentioned before. BHC, as a spray has been tested in concentration of 0.25 per cent against pyrilla on sugarcane and cabbage aphis (*Brevicoryne brassicae*). Preparations of BHC tested were supplied by the various firms under the trade names, Gammexane, Hexidole, Hexyclan, Benexide, Cit-hexastaub and Diatomite.

Chlordane (Octochloro-tetrahydro-methanoidane=$C_{10}H_6Cl_8$).—Wettable powder 550 from Ortho California Spray Chemicals and Chlordane supplied by Industrial Progressive Corporation, Delhi was tried as 1 per cent dust on tomato crop against virus vectors and it was observed that the condition of tomato crop improved, as was the case in spraying the crop with 0.1 per cent chlordane.

Toxaphene (Mixture of chlorinated terpenes=$C_{10}H_{10}I_8$). Toxaphene supplied by Hardcastle Waud & Co., Bombay was tried in concentration of 10 per cent dust on gourd against the attack of red pumpkin beetle. The insecticide gave 90 per cent kill of the pest but was found to be phytotoxic to the foliage of bottle gourd (*Lagenaria vulgaris*). Toxaphene under the proprietary name ' Murtox 2 ' (Murphy), a wettable power was tried on turnip crop against the cabbage aphis and cabbage butterfly in Nagar (Kulu) in concentration of 0.2 per cent with good results but it was observed that the aphids which escaped the spray were able to multiply and infest the sprayed parts within 3-4 days of spraying.

THIOCYANATES

Lethane (Beta-beta-dithiocyano-dimethyl-ether).—Lethane B-71 (1.5 per cent) dust and B-72 (13 per cent) WP were supplied by M|s Amrit Lal & Co., Bombay. The dust gave about 90 per cent kill of pyrilla and 0.1 per cent spray was fairly well effective against pyrilla and cotton jassids.

PHOSPHATIC INSECTICIDES

TEPP (Tetra-ethyl pyrophosphate).—TEPP contained in ' Vapotone ' spray was tested and found effective against various species of aphids infesting crops in Delhi in the different seasons. While 0.0125 per cent (TEPP) solution was effective against aphids, the concentration had to be doubled (0.025 per cent) in controlling effectively cotton jassids (*E. devastans*), cotton white fly (*Bemesia tabaci*) and red mites infesting cotton, lady's fingers and beans.

Parathion (Diethyl para-nitrophenyl thiophosphate).—The proprietary formulations of parathion tested were ' Folidol E 605 ' (Bayer) and Ekatox 20 (Sandoz) both of which gave satisfactory results. The former was supplied as a liquid concentrate only while the latter as liquid concentrate, wettable powder and dust. Parathion was found effective in concentration of 0.05 per cent against bean aphis (*Aphis medicaginis*) and cotton red mites infesting bean crop and Lady's finger respectively. In higher concentration of 0.1 per cent, it proved effective against citrus red scale (*Aonidiella aurantii*) and mango mealy bugs (*Drosicha mangiferae*).

SYSTEMIC INSECTICIDES

The systemic insecticides under the proprietary name 'Pestox' supplied by the Pest Control, Ltd., Cambridge and ' Tetrax ' sent for trial by the Imperial Chemical Industries (India) Ltd. both containing Octamethyl tetra amido-pyrophosphate or bis (bis-dimethylamino phosphonous) anhydride as the active ingredient, were tried. In concentration of 0.05 per cent ' Pestox ' gave a low kill of mango hoppers (*Idiocerus* spp.) and in concentration of 0.1 per cent, it was found effective against cotton jassid (*Empoasca devastans*). Its residual effect lasted for about 10 days. ' Tetrax ' was tested in concentration of 0.1 per cent and 0.25 per cent on cabbage crop against the cabbage aphis (*Brevicoryne brassicae*) in October and April in Naggar (Kulu). Both the concentrations were highly effective, the difference being that the lower dose took a longer time in killing the pest. The residual toxicity lasted for about 12 days in October.

BOTANICAL INSECTICIDES

(i) *Pyro-colloid* was mostly tried in concentration of 1 : 800 (0.004 per cent pyrethrin) with satisfactory results against mustard aphis (*Rhopalosiphum pseudobrassicae*), brinjal tingid bug (*Urentius echinus*), cotton white fly (*Bemisia tabaci*), thrips on (*Colocassia*, cotton jassid (*Empoasca devastans*)and citrus psylla (*Diaphorina citri*).

(ii) *Pyrodust* was effective against red pumpkin beetle (*A. foveicollis*) damaging cucurbitaceous crops, cotton aphis (*Aphis gossypii*) and cotton jassid (*E. devastans*) infesting Lady's finger and flea beetles (*Phyllotreta cruciferae*) causing shot holes in the foliage of radish, mustard, turnip and brinjal etc. The extent of mortality caused was between 80 and 90 per cent. It was observed that spraying with pyrocolloid (0.004 per cent to 0.005 per cent pyrethrin) was more effective than dusting with pyrodust against the sucking insects.

(iii) *Nicotine.*—40 per cent nicotine sulphate (Campbell's) tried in concentration 0.05 per cent was found effective against the leaf mining larvae of citrus psylla (*Phyllocnistis citrella*) and bean leaf red miner (unidentified) and the larvae and young pupae of pea leaf miner (*Phytomyza atricornis*). Nicotine was also effective against cotton aphis (*A. gossypii*), bean aphis (*A. medicaginis*) and mustard aphis (*R. pseudobrassicae*) in concentration of 0.05 per cent. It was observed that preparation of nicotine 98 per cent or nicotine 40 plus (Campbell's) were more effective than nicotine sulphate when tried in similar concentrations. 98 per cent concentrate in concentration of 0.05 per cent was also effective against cabbage aphis (*Brevicoryne brassicae*) without the addition of any soap. ' Nicotox 20 ' (Sandoz) was also found effective against cabbage aphis in concentration of 0.05 per cent. The wettability and spread were good but the aphids that escaped the spray were found to multiply rapidly after three days.

' Nikopren ' (Fedco-German) tried in similar concentration as above against cabbage aphis at Naggar (Kulu), proved to be highly effective because it killed the pest both by contact and fumigation action. Nicotine 40 plus (A. Manual & Co.) tried so far on a limited scale against cotton aphis (*A. gossypii*) infesting cucurbits, gave good results.

SULPHUR

Sulphur dust (I. C. I. high grade) gave 60—80 per cent kill of cotton mites but when the population of mites was very high, spraying with TEPP as stated above, was more effective than dusting with sulphur.

PLANT PROTECTION WORK (MYCOLOGICAL) DONE IN THE MADRAS STATE DURING THE QUARTER ENDING 31ST MARCH 1953

In 14 districts of the State, paddy seed sufficient to sow over 8,823 acres was treated with Agrosan GN, as a protective measure against ' foot-rot ', ' helminthosporiose ' and other seed-borne diseases. Besides, in 13 districts, about 1,122 acres of paddy nursery were sprayed with copper fungicides against the ' blast ' disease. In addition, over 98 acres of paddy crop were treated with copper sulphate against algal weeds, and 18 acres of crop against the ' sterility ' disease.

In 13 districts, Jowar seed sufficient to sow about 32,697 acres was dressed with sulphur (1 oz. per 15 lbs. of seed) as a preventive measure against ' smust '. Besides, in Bellary and Ananthapur districts, Italian Millet seed, to sow over 75,451 acres, was similarly treated against ' smut '. Besides, about 119 acres of Ragi, spread over 10 districts, were sprayed with Perenox (3|4 oz. in 1 gallon of water), against the ' blast ' disease.

Chilli crop covering an area of over 637 acres, and spread over 14 districts, was sprayed with Perenox against the ' fruit-rot & die-back ' and ' mildew ' diseases. In addition, in the Krishna, Guntur and Chittoor districts, ' virus ' affected Chilli plants were eradicated over an area of 79 acres. In the Srikakulam, Guntur, Cuddapah, Kurnool Bellary South Arcot and North Arcot districts, 47.71 acres of Onion and Garlic crops were sprayed with perenox against ' leaf-blight ' and ' leaf-spot ' diseases respectively. In Tiruchirapalli and Guntur districts, 3½ acres of turmeric crop were sprayed with Bordeaux Mixture (1 per cent) or Perenox against ' leaf-spot ' disease. Brinjals affected with (virus) were rogued out of 132 acres of the crop in Srikakulam, Vizagapatam, West Godavari, Krishna, Guntur, Cuddapah and Bellary districts. Tomato crop, covering an area of over 80 acres in 11 districts, was treated against ' blight ', ' wilt ', ' fruit-rot ', ' powdery mildew ', and ' virus ' diseases. In the Salem district, 7½ acres of potato crop were sprayed against ' early-blight '. Besides, over 35 acres of several vegetable crops were sprayed or dusted with fungicides against ' damping-off ', ' leaf-spot ', ' powdery-mildew ' and other diseases.

Citrus trees, distributed over 23 districts of the State, were treated as follows :—32,431 trees against ' foliocellosis ', 25,514 trees against ' gum-mosis ', 19,343 trees against ' die-back ' & ' canker ', 3,109 trees against various nutritional deficiency diseases, 9,425 trees against ' diplodia ', ' twig-blight ', 135 trees against ' sooty-mould ', and 70 trees against ' fruit-fall ' (physiological). In 11 districts of the State, over 7,281 mango trees were treated with various fungicides against ' powdery-mildew ', ' leaf-spot ', ' die-back ' and ' gummosis ' diseases. About 113 acres of grape-vines in Mathurai, Ramanathapuram, Tiruchirapalli, Coimbatore and Tirunelveli districts, were sprayed with Bordeaux Mixture against ' downy-mildew '. In the Guntur, North Arcot and Srikakulam districts, 113 ' wilt ' affected banana plants were eradicated, and about 6 acres of the crop sprayed with copper fungicides against ' leaf-spot '. In the Nilgiris district, 75 plum and 87 peach trees were also sprayed with

fungicides against the ' black-spot ' and ' leaf-curl ' diseases respectively. In addition in the Srikakulam district, 4 Jack trees were sprayed with copper fungicides against the ' fruit-fall ' disease.

Dipping the setts in Perenox solution before planting as a prophylactic measure against ' red-rot ', and eradication of smutted shoots were carried out over an area of 394 acres of sugarcane crop. Ginger rhizomes, sufficient to plant about 97 acres, were treated with Mercuric chloride solution prior to storage, as a protective measure against ' soft-rot '. Over 491 acres of tobacco in coimbatore, Srikakulam, Vizagapatam, East Godavari, West Godavari, Krishna, Guntur, Nellore, Cuddapah and Bellary districts, were treated against ' leaf-spot ', ' damping-off ', ' powdery-mildew ' diseases, and eradication of ' virus ' affected plants and the ' orobanche ' parasite was also carried out. In the Tirunelveli district, about 2 acres of cotton crop were sprayed against ' mildew '. In the Salem, Tiruchirapalli and Vizagapatam districts, over 32 acres of betelvine crop were given soil-treatment with Perenox solution as control against the ' wilt ' (foot rot) disease.

In the South Kanara, Pattukottai, North Malabar, South Malabar, Tanjore, Coimbatore and Tiruchirapalli districts, over 7,949 coconut trees were treated against ' stem-bleeding ', ' foot-rot ', ' leaf spot ' and ' bud-rot ' diseases. In the Nilgiris district, 60 acres of Coffee crop were sprayed with fungicides against ' rust '.

In the Nilgiris and South Kanara districts, 219 rose and 2.75 acres of Carnation plants were also sprayed with fungicides against ' black-spot ' ' sooty-mould ', etc.

In the West Godavari, Guntur and Cuddapah districts, over 89 unwanted trees were eradicated by the application of ' Agri Tree-killer ' solution.

EFFECT OF SOME NEW INSECTICIDES ON BEES AND CROPS

by

H. L. Kulkarny, M.Sc., (Agri.)
Institute of Agriculture, Anand.

The primary aim to-day, is to prevent insects from causing damage to food crops. The present practice of the control of crop pests is more by insecticides than by other methods. It may be that results are very often immediately obtained. But then sufficient experiences and observations are being accumulated to warrant the use of chemicals against insect-pests on crops or at least, they need to be used with some caution. Several workers like William C. Roberts, Otto Mackensen, have noticed the residual effects of insecticidal chemicals on plant growth, on useful insects such as bees, useful parasites and predators etc. Observations are also being made by workers in the west on the effect of insecticides on soils. However, in this country, little or practically no attention is paid to collection of such an important data on the well being of Agriculture as a whole. During 1952, the author particularly observed and collected certain data on the effects of DDT and BHC on soil, plants and the other useful insects. Following is the brief summary of the data. In the cotton fields the plots treated with calcium arsenate for the control of boll worms were comparatively less visited by the honey bees. In fact, on certain days during October and November some dead bees were collected indicating the poisonous effects of the insecticide on the bees where as in plots treated with DDT water suspension sprays at concentration of 0.2 per cent, on an average 2 to 2.7 bees were found working per bush during the same month.

Further, with regard to lady bird beetles, almost similar observations were made in the fields during December and January. The plots treated with calcium arsenate for the control of boll worms, favoured an appreciable increase in the population of aphids on the plants on account of the white colouration imparted to the plant. The infestation rose from 0.3 aphids per sq. inch to 34.1 aphids on a medium sized leaf. Such of these populations were less attacked by lady bird beetles and their grubs. But in the other plots lady bird beetles and their grub were noticed to the extent of 4 to 7 grubs per heavily infested leaf. It may be argued that aphids having received a spray of calcium arsenate turned poisonous to the food of predacious beetles and therefore less incidence of such predators was observed. No chrysopa eggs were collected from such cotton plants where as an average of 42.6 eggs were accounted for from 100 plants treated with insecticides other than calcium arsenate.

A number of complaints were received regarding defective germination in cotton and wheat when seeds were treated with BHC insecticides. Laboratory experiments were laid out in replicated trials to study their effects on plants. It was noticed that when seeds and previously germinated seeds were treated with 5 per cent wettable BHC, the treatment severely affected the germination of seeds, where as in case of similar trials with DDT the treatment acted favourably showing extra vigour in the treated pots. Field experiments are being laid out shortly to confirm the findings.

INCIDENCE OF LINSEED RUST DURING 1953

B Singh, *Plant Pathologist to Government, U.P.*

AND

T. N. Shukla, *Assistant Mycologist.*

A scheme for investigations on linseed rust on all-India basis has been started at Kanpur, U.P., since September 1952 under the auspices of the Indian Oil Seeds Committee. The staff toured through the important linseed growing areas of Uttar Pradesh, Bhopal, Vindhya Pradesh and Madhya Pradesh to survey the incidence of the disease and collect specimens of the rusts. Information regarding the occurrence of rust was also gathered from Plant Pathologists of various States, which has been included in this report. The rust situation in various States was as follows :—

UTTAR PRADESH

Locality	Variety	Incidence percentage
Allahabad	..	20—30
Bansi (Distt. Basti)	..	90—100
Banaras	Pusa 12.	40—50
Bahraich	1193	100
Chakia (Distt. Banaras)	..	30—40
Chandauli (Distt. Banaras)	..	30—50
Gonda	..	80—90
Gorakhpur	..	90—100
Meja Road (Distt. Allahabad)	..	20—30
Mirzapur	..	50—60
Robertsganj (Distt. Mirzapur)	..	80—90
Tissai Farm (Distt. Mirzapur)	T. 1	90—100
Tulsipur (Distt. Gonda)	..	90—100

L/M17DPPQ&S

MADHYA PRADESH

A thorough search was made in various linseed growing areas but it was found only at two places given below :—

Locality	Variety	Incidence percentage
Warseoni	N. 3 N. 55	90—100 80
Raipur	N. 3 N. 55	50—60 25

VINDHYA PRADESH

A thorough search was made in various linseed growing areas of the Pradesh but no rust was observed.

BHOPAL

The Central Research Farm, Lakhapur, Bagh Saiwaina and other parts of the State were surveyed, but no rust could be noticed.

EAST PUNJAB

Rust specimens were received through the Plant Pathologist, East Punjab, Ludhiana. The incidence of the disease as reported by him is given below :—

Locality	Variety	Incidence percentage
Gurdaspur	H. 54 Br. 1	5 5

BIHAR

Rust material on various varieties of Linseed was received from the Plant Pathologist, Sabour (Bihar). The incidence of the disease reported on the varieties is given below :—

Locality	Variety	Incidence percentage
Botanical Research area, Sabour, Bhagalpur	Br. 1	10—15
	Br. 9	5—10
	Local	10—15
	Culture No. 42	40—50
	Culture No. 32	30—35
	Culture No. 1	4—5

WEST BENGAL

Various reports from different parts of the State revealed that Linseed is grown in a negligible area and no rust was observed.

BOMBAY

No linseed rust was reported this year from Bombay State.

AN UNUSUAL EPIDEMIC OF THE CASTOR HAIRY CATERPILLAR, *EUPROCTIS LUNATA* WALKER IN DELHI

We know of the irritation caused by some hairy caterpillars but the type of aggression caused by the castor hairy caterpillers described below was not known before. In the rainy months of July and August 1951, *Euproctis lunata* owing to favourable weather multiplied so abundantly on castor plants in the vicinity of residential bungalows in Hardinge Avenue at New Delhi and Government Quarters, Karol Bagh, Delhi that it almost occurred in an epidemic form. The larvae having finished castor foliage started migrating in search of food and in doing so they not only started feeding on many plants hitherto unrecorded but entered the residential bungalows and proved as a great nuisance to the inmates of those places by causing irritation with their urticating glandular hairs. All the residents developed urticaria or nettle-rash by constantly scratching their limbs which came in contact with the larvae direct or their infested material and the disease was of great significance among the children, because they were highly susceptible to its ill effects. They were taken to the doctor for treatment. In some cases the children were shifted to other places for safety. The adult members of the family passed sleepless nights. The worst was that their servants refused to work in kitchens and the labourers employed on eradicating castor plants ran away after working for an hour owing to severe irritation caused by the caterpillars on their bodies. Thus those living in tents had to almost surrender their accommodation to the pest. It was all an unhappy scene and a problem to control the pest.

Host plants.—The pest is already known as a severe pest of fruit trees in the Punjab and is commonly termed as ' phalon ka katra '. It was however found to be sporadically bad pest of castor only in the N.W.F.P. (W. Pakistan). In Delhi it has been found to damage variety of plants. Those already known and recorded for the first time are summarised below :

Host plants already recorded	Host plants recorded in Delhi for the first time
Mango, plum, apple, jujube, mulberry, pomegranate and grapevine.	Banana, guava, peach, loquat, plum, citrus (malta, santra, nimboo), litchi, papaya, fig, ' Jamun ' mulberry, ' *anwala* ' (*Phyllanthus emblica*), castor, sorghum, ' *mung* ', ' *Suanjana* '
Foliage of castor, rose and ' babul '(*Acacia arbica*).	(*Moringa oleifera*), brinjal, jasmine, *Tecoma grandiflora*, prosopis, Acacia, ' *Pilkhan* (*Ficus infectoria*), ' *ratua* ', *belgiri* and ' *lewa* ' weed.

Control measures.—The control of the pest was effected by the application of DDT or BHC. Both these insecticides were used in higher concentrations than usually employed. BHC was used in concentration of 10 per cent as a dust and DDT in concentrations of 0.25 per cent to 0.4 per cent as a spray. In case of DDT higher concentration of 0.4 per cent was used

with a view to effect almost immediate control in spraying it on the wandering caterpillars infesting residential premises as explained above. Later on it was found that 0.25 per cent concentration of DDT was enough to control the pest. It also died by feeding on the sprayed plants. All the areas wherever the caterpillars had dispersed, be it a plant, grass or in and out portions of the houses were thus either sprayed with 0.25 per cent DDT or dusted with 10 per cent BHC. In case of 10 per cent BHC dusting, a marked reduction in the population of the pest was noticed after 12 hours. In case of 0.25 per cent DDT spraying the wandering larvae were affected gradually after they were sprayed or when they moved through the sprayed areas. After about 12 hours it was observed that the larvae were restless. They were found to raise their heads and they often fell on their backs. The larvae began decreasing in their number day by day and the owners got completely relieved of the pest on the third day after treatment.

OBSERVATIONS ON KNOWN AND NEW DISEASES OF FIELD CROPS IN UTTAR PRADESH DURING 1951-52

by

P. R. Mehta, Babu Singh and S. C. Mathur.

1. *A new leaf spot disease of bajra.*—A severe leaf spot disease was observed in the months of July, August and September on bajra plants at Research Farm, Kanpur. A species of *Piricularia* was isolated from the spots. Round to elliptical spots were produced on the leaves. Concentric rings from 2 to 7 in number develop on the necrotic regions of the spots.

The disease is produced on the leaves within four to six days after inoculation with spore suspension. The cross inoculation tests showed that the spores of *Piricularia* sp. on paddy could not infect bajra and vice versa.

2. *Varietal resistance of Jowar to grain smut (Sphacelotheca sorghi).*—Twenty promising jowar varieties were tested against grain smut (Smut collected from all over U.P.). Two varieties viz. 31B and 4101 again showed high resistance. Three varieties viz. 10EK, 4403 and 4801 (a) were also found to be moderately resistant.

3. *Control of leaf-spots (Cercospora personata and C. arachidicola) of groundnut.*—Sulphur dustings at the rate of 16 lbs. per acre at ten and fifteen days intervals greatly reduced the disease and increased the yields by about 40 and 30 per cent respectively. The sprayings with Bordeaux mixture (2-2-50), Perenox (0.15 per cent) and Cupravit (0.15 per cent) at fifteen days' interval increased the yields by about fifteen, twenty and thirty per cent respectively in late maturing varieties. No significant increase in yield was obtained with early maturing varieties in all the treatments.

4. *Varietal reaction of ground-nut to root-rot (Sclerotium rolfsii).*—Twelve varieties were tested for the purpose. Three varieties kept as controls viz. R3, R7 and T318 showed high susceptibility and two varieties viz. T1 and T15 showed slight susceptibility (below 2 per cent infection) and rest of the varieties viz. 6-2, 11-11, 14, 16-4, 17, 19, 22, 24, 25 and 4201 showed no infection.

5. *Varietal reaction of barley to covered smut (Ustilago hordei) and stripe disease (Helminthosporium gramineum).*—Twenty promising varieties were tested separately for their resistance towards covered smut and stripe disease. The variety K12 proved to be resistant and N13 fairly resistant to both the diseases. The huskless variety CN292 proved resistant to stripe disease but susceptible to covered smut, while CN294 showed resistance to covered smut and susceptibility to stripe disease. Variety C 84 proved resistant to covered smut and fairly resistant to stripe disease while the culture 42|72 showed resistance to stripe disease and fair resistance to covered smut.

6. *Bunts of wheat.*—Heavy incidence of Karnal bunt (*Neovossia indica*) was observed in Mathura district and seed samples received from the cultivators showed 60 to 100 per cent contaminated seeds.

The examination of seed samples from the hill districts showed the prevalence of true bunt (*Tilletia foetida*) at the following seed stores :—

District Nainital .. Padampuri, Nathua Khan.

District Almora .. Pithoragarh, Barachhina, Someshwar.

District Garhwal .. Pauri Garhwal, Gadoli.

7. *Epidemic of loose smut of wheat in Doon valley.*—Loose smut of wheat (*Ustilago tritici*) occurred in epidemic form in Dehradun and Saharanpur districts. The variety affected was Pb. 591.

8. *Varietal trial against loose smut of wheat.*—Twenty two promising varieties of U.P. were tested. The varieties Bansi, C.P., Bansi Pali 808 and NP 710 showed high resistance and NP 165 fair resistance to loose smut.

9. *Ear cockle disease of wheat.*—Ear cockle disease (*Anguillulina tritici*) is becoming a serious menace to the cultivation of the wheat in western districts, specially Mathura, Aligarh, Etah, Meerut etc. and in the district of Gonda in eastern U.P. The disease was also found in the year under review at Kanpur. The disease is found to carry over from year to year mainly through the seeds. The treatment of seeds by solar energy method and its various modifications have not controlled the disease though reduction in the incidence was obtained by drying the presoaked seeds for four hours on sand exposed to sun. Sowing the clean seeds by ' dibbler ' has checked the disease.

10. *Varietal trial against wilt of gram.*—Ten varieties were sown in wilt nursery for the purpose. None of the varieties showed resistance. The popular variety in the State—T87 and NP25 proved susceptible to wilt.

SUMMARY OF PLANT QUARANTINE REGULATIONS OF BURMA*

Importation Prohibited

1. Unginned cotton.

2. Cotton seeds except imported by the Economic Botanist by sea through the port of Rangoon under specified conditions.

3. Gram (*Cicer arietinum*), excluding split gram seeds for consumption.

4. Mexican Jumping beans (*Sebastiania palmeri*), plant and seeds.

5. Sugarcane from Fiji Islands, New Guinea, Australia and Philippine Islands.

6. Coffee plants, seeds, or beans except those imported by the Director of Agriculture.

Restrictions on means of transportation

1. No plant shall be imported by means of letter or sample post. except sugarcane intended to be grown under the supervision of the Economic Botanist, or the Deputy Director of Agriculture, East Central Circle.

2. No plant shall be imported by air, except the following :

(i) small quantities of plants or parts thereof carried on aircraft as foodstuffs ;

(ii) plants which are used for introducing living insects when accompanied by a special certificate from the Economic Botanist ;

(iii) sugarcane imported by the Economic Botanist and the Deputy Director of Agriculture, East Central Circle ;

(iv) rubber budwood under the special authorization of the Director of Agriculture.

Fumigation required

No plant other than vegetables for consumption, potatoes and unmanufactured tobacco shall be imported unless after fumigation with hydro-cyanic acid gas at the port of Rangoon, except (1) the plants used for introducing living insects when accompanied by a special certificate from the Economic Botanist and (2) rubber plants, stumps and budwood grown in Java, Sumatra, the Malaya States or the Straits Settlements.

Official certificate required

No plant other than unmanufactured tobacco imported from India or fruits or vegetables for consumption shall be imported by sea unless

*Extract from "Digest of Plant Quarantine Regulations", FAO, Rome, 1952.

accompanied by an official certificate granted by the proper authority in the country of origin stating that they are free from injurious insects and diseases.

Importations specifically restricted

In addition to the official certificate mentioned above the following importations are restricted further by additional requirements.

1. *Potatoes.*—Requiring a special official certificate from the proper authority in the country of origin stating the District and Country of origin, certifying that wart disease (*Synchytrium endobioticum*) was not known to exist on the land where the potatoes were grown, that no case of wart disease had been known during 12 months preceding the date of the certificate within 5 miles (or 8 kilometers) of the place where the potatoes were grown, and that the consignment is entirely free from Colorado beetle or eggs.

2. *Rubber plants.*—Require an official certificate that they are free from *Oidium heveae.* Hevea rubber plants and seeds from America, West Indies, Brazil or Ceylon require the special authorisation of the Director of Agriculture.

3. *Lemon, lime, orange, and grapefruit plants and cuttings.*—Require an official certificate stating that they are free from *Mal secco* caused by *Deuterophoma tracheiphila* and gummosis disease caused by *Phytophthora citrophthora.*

4. *Sugarcane* from countries other than Fiji Islands, New Guinea, Australia and Philippine Islands. Requires the authorization of the Economic Botanist or the Deputy Director of Agriculture, East Central Circle, or an official certificate stating that it has been examined and found free from cane borers, scale insects, white flies, root diseases, sereh dwarf disease, leaf scald, downy mildew and cane gummosis, that it was obtained from a crop free from mosaic and streak disease and also that the Fiji disease of sugarcane does not exist in the country of export. All importations shall be held under quarantine for one year.

5. *Tobacco seed.*—Importation is prohibited except under and in accordance with the terms and conditions of a licence issued by the Economic Botanist.

Importation unrestricted

1. Fruits and vegetables intended for consumption

2. Roasted or ground coffee.

SOME IMPORTANT DISEASES OF ECONOMIC PLANTS—UNKNOWN OR LITTLE KNOWN IN INDIA—TRANSMITTED IN NURSERY STOCK*

I—Sugarcane.

1. *Fiji Disease* (Sugarcane Fiji Disease Virus ; Saccharum Virus 2 Kunkel).

Occurrence : Australia (New South Wales, Queensland), Fiji Islands, Java, New Britain, New Guinea, Philippines, Samoa, Solomon Islands.

Losses : Up to 90 per cent of the crop.

Distinguishing features : Elongated galls along the veins on lower surface of leaves and in the vascular bundles of stems ; crumpling of younger leaves as though nipped by an animal ; severe stunting of plant followed by death.

Control : Careful sett selection ; roguing of affected plants ; resistant varieties.

2. *Sereh Disease* (Sugarcane Sereh Disease Virus ; Saccharum virus 3 Kunkel).

Occurrence : Brazil, Java ; reported from Australia, Borneo, Ceylon, Formosa, Hawaii, Indo-China, Malacca, Malaya, Mauritius, Sumatra. Also India (?).

Losses : 20 to 60 per cent of the crop.

Distinguishing features : Red gumming substance in the vascular tissues of the stalks ; pronounced growth of adventitious roots under the leaf sheaths; stunting and conversion of the stool into a bushy tuft of leaves.

Control : Resistant varieties ; careful sett selection ; hot water treatment of setts at 52°C. for 30 minutes followed by drying for one day before planting ; roguing and burning.

3. *Gummosis or Gumming disease* (*Xanthomonas vasculorum* (Cobb) Dowson).

Occurrence : Antigua, Australia, Barbados, Brazil, Colombia, Dominica, Fiji, Guadaloupe, Madiera, Mauritius, New Guinea, Puerto Rico, Reunion, St. Kitts, St. Lucia.

Losses : Has often been responsible for complete failures of the crop.

Distinguishing features : Greyish longitudinal depressions along internodes ; pale green to almost pure white patches or longitudinal stripes

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*It is intended to include in this series destructive diseases whose chief practical measure of control lies in checking their entry through effective quarantines.

on the leaf blades only; reddening of vascular bundles and exudation of yellow slime from freshly cut ends of stems ; stunting and decay of terminal buds.

*Other hosts** : *Zea mays, Bambusa vulgaris, Cocos nucifera, Coix lacryma-jobi, Panicum maximum.*

Control: Resistant varieties; careful sett selection.

4. *Leaf Scald or Java Gum Disease* (*Bacterium albilineans* Ashby).

Occurrence : Australia, Brazil, British Guiana, Fiji, Formosa, Hawaii, Japan (?), Java, Madagascar, Mauritius, New Guinea (?), Nossi-Be, Philippines, Reunion.

Losses : A major disease reducing sugar yields considerably and ultimately causing death of affected plants.

Distinguishing features : Bright red longitudinal discoloration of vascular bundles about the nodes and near the growing points ; no exudation of gum from cut ends of stalks ; production of side shoots at the base of the main stalk ; elongated, narrow, white or yellowish white stripes on leaves extending to the sheath and often studded with minute reddish-brown spots ; older streaks wider, diffused and surrounded by a dead tissue giving the leaf a scalded appearance.

Control : Resistant varieties ; healthy planting material† ; rogueing of diseased plants.

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*Indicated where known as these may serve as potential sources of infection.

†It may be particularly noted here that certain varieties may not show any external symptoms at all, while they act as ' carriers ' and should be carefully guarded against.

NOTES AND NEWS

(i) Insect Repellent*

Insect Repellent, 2, 4-Trimethyl-1- 3-pentanediol is now being tried as an insect repellent in United States. The material is white crystals of melting point 51°C and boiling point 125° to 127°C.

(ii) Foreign Leafhopper gets Foot hold in North American**

An undesirable alien, the European leafhopper, has established itself in North America. This discovery was made by Dr. Herbert H. Ross, Entomologist of the Illinois Natural History Survey, Urbana.

Dr. Ross found this European leaf-hopper in an insect collection from British Columbia. In Europe this leaf-hopper feeds on a variety of shrubs and trees.

(iii) A new Rodenticide†

A new anticoagulant rodenticide, named Pival is now being tested and it is thought, may eventually outclass warfarin. This rodenticide is now being tested as a dry bait concentrate and water soluble salt (Pivalyn). It is claimed that the new product is insecticidal, both on shelves and when laid as bait does not foul or slime easily, has certain roach-killing properties and some ectoparasitic ability—i.e., it kills body lice which suck the rodents' blood and which carry typhus, commercial production of this new rodenticide is expected to start soon as a result of satisfactory tests to-date.

(iv) New Plant Insecticides‡

A new plant insecticide has been described by the Mexican Bureau of Entomology and Plant Quarantine from the plant *Heliopsis longipes* which is as toxic to house flies as the pyrethrins. A similar substance. scarbia, has been isolated from roots of the same genus growing over the United States—*H. scarbia, H. gracilis* & *H. parvifolia.*

(v) Farmers spend $300,000,000 annually for Pest Control materials in United States†

Mr. O. V. Wells, Chief of the Bureau of Agricultural Economics. reviewed farm outlook and stated that " Farmers ' expenditures for pest control materials may well have exceeded 300 million dollars in 1951 or the equivalent of about 1 per cent of the value of all farm sales ". As a comparison he continued " you may be interested in knowing that farmers spend something more than 900 dollars or close to 3 per cent of the cash value of all farm sales for fertilizer in 1951 ".

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*Chemical and Engineering News, Vol. 30, No. 47, 1952, p. 4987.

**Science News Letter Dec. 13, 1952, p. 376.

†Extract from Manufacturing Chemist, Vol. XXIV(I), p. 9, 1953

‡National Agricultural Chemicals Assn., Sept.-Oct. 1952, Vol. 11, No. 1 p. 1.

Farmers were purchasing about 10,000 power sprayers and dusters annually prior to 1940, mostly of the large volume type whereas during the last five years, farmers in the U.S.A. have brought some 400,000 power sprayers and dusters or 60,000 to 1,000,000 annually, about 80 per cent of which were field or row crop sprayers. He reported that there are now about 1,900 operators with some 5,500 airplanes also for custom work. Mr. Wells was addressing the members of the National Agricultural Chemicals Assn. during the 19th Annual Meeting.

(vi) Protecting stored Corn (Maize) from Grain Insects by Bags impregnated with DDT*

Closely woven cotton bags dipped into, or sprayed with 10 per cent DDT solution in carbon tetrachloride gave protection for 18 months to maize within bags.

(vii) The Introduction of *Dizygomyza cepae* Hering in Malaya**

Dr. H. T. Pagden, Senior Entomologist of the Department of Agriculture, Kuala Lumpur, Federation of Malaya, has recently informed this Directorate that the Agromyzid pest (*Dizygomyza cepae* Hering) has been recorded on shallots (*Allium esculentum*) in Malaya also. This insect has not hitherto been recorded outside Europe. The news of its occurrence in Singapore is very important to this country so that necessary steps may be taken to prevent its entry into this country also. The survey made in Malaya has shown that the pest was established in many places and over quite wide areas. It was found also to be established in South Johore. The research is being continued.

(viii) First Record of Cotton Stem Moth (*Platyedra vilella* Zeller in U.S.A.)†

The cotton stem moth, *Platyedra vilella* Zeller, has been reported for the first time from the United States. This insect was taken from hollyhock at Mineola, Long Island, New York.

The cotton stem moth, is known to occur in France, Russia, the Caucasus, Transcaucasia, Iran, Iraq and Morocco. Its host plant include various species of cotton, high mallow (*Malva sylvestris*) ; velvet tree-mallow (*Lavatera arborea*) and herb treemallow (*Lavatera trimestris*)

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*Bull. Ky. agric. Expt. Sta. 5 TI, 1951, p. 8.

**Based on letter received by the Directorate of Plant Protection, Quarantine and Storage, New Delhi.

†The Extract from F.A.O. Plant Protection Bulletin, Volume I, No. VI, pp. 90-91, 1953.

In 1932, the cotton stem moth caused serious damage to cotton in northern Persia. In Uzbekistan, it was found abundant on wild malvaceous plants in 1936. This insect is a very close relative of the pink bollworm. (It has not been recorded in India).

(ix) Mandarin Decline*

A slow decline of mandarins on rough lemon stock has been evident in Queensland for some years. Recent investigations indicate a virus infection as being responsible for the decline. The identity of the virus and its relationship to other viruses in the citrus virus complex have not been determined. Symptoms of decline in each of the mandarin varieties bear marked similarities.

Affected trees take on a rounded, squat appearance as a result of their sparse, short-wooded manner of growth, and suffer considerable twig dieback. A bright yellowing of the leaves, commencing as a yellowing of the veins, is a prominent feature and such leaves show a downward curling of the tip. Declining trees produce light crops and the fruit is slightly irregular in shape with a coarse rind.

The mandarin decline virus is transmitted by budding. Therefore, it seems at present inadvisable to propagate mandarin varieties on rough lemon stock until more information is obtained as to the presence of the virus in budwood sources.

(x) Chemotherapy—A Note†

Chemotherapy has scored another success on the growing list of plant diseases that can be controlled or decreased by this new method. Recently, E. M. Stoddard, Plant Pathologist at the Connecticut Agricultural Experiment Station, found that the fungus disease, *Rhizoctonia*, on stock or gillyflower plants could be controlled by soil applications of 8-quinolinol sulfate.

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*Extract from Queensland Agricultural Journal, 76, 2, pp. 68—75, Feb. 1953.

†Extract from "Seed World", p. 40, Nov. 1952.

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